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ABSTRACT

This research study centers on the interrelations among culture, social change, informal education, and cognitive development. The study explored how changing cultural and social conditions influence processes of informal education and their cognitive consequences. The overall goal was to examine the relationship between important cultural tools, techniques of informal education, cognitive processes, and the ecology of a changing world. Two sets of studies were done in two very different societies, one Zinacantan (an indigenous Maya community in Chiapas, Mexico) and the other the United States. The focus for each was on the nature of the learning processes and the cognitive consequences of mastering a major technology indigenous to that particular setting, weaving in Mexico and video games in the United States. Findings for each of the societies are reviewed. (EH)

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Final Report to the Spencer Foundation

CULTURAL TOOLS AND LEARNING PROCESSES IN A CHANGING WORLD

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Focus of the Research

This research centered on the interrelations among culture, social change, informal education, and cognitive development. We explored how changing cultural and social conditions influence processes of informal education and their cognitive consequences. The overall goal was to examine the relationship between important cultural tools, techniques of informal education, cognitive processes, and the ecology of a changing world.

Two sets of studies were done in two very different societies; each one illuminated the educational and cognitive consequences of sociocultural change taking place in that particular culture. One society was Zinacantan, an indigenous Maya community in Chiapas, Mexico; the other was the United States. For each society, te focus was on the nature of the learning processes and the cognitive consequences of mastering a major technology indigenous to that particular setting. In Zinacantan, the technology was

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weaving. In the United States, the technology was video games. For each society, the claim can be made that the respective technology constitutes the most complex indigenous technology that is mastered on a mass scale by children in that particular culture.

In Zinacantan, the focus was on changes in the interactional processes of informal education that take place when an ancient tradition-bound society enters into the entrepreneurial cash economy of a modern nation. Our research in the Zinacanteco hamlet of Nabenchauk explored the effects of social change directly, by utilizing a unique opportunity for a natural experiment: the project was a two-decade follow-up to field research that had been done in 1969 and 1970 by the principal investigator when the Zinacantecos were more isolated from modern Mexican society and more focused on maintaining an ancient Maya way of life. The study of modernization investigated how a transition from agricultural subsistence to entrepreneurial commerce affects the informal interactional processes that constitute cultural transmission from mother to daughter. A second part of the research explored, through replicating an experiment carried out in 1969 and 1970, changes in cognitive representation as a function of economic development and increased formal education. In both cases, the basic research design was a controlled historical comparison of two generations of the same families living in the same community.

In the United States, the focus was on the cognitive effects of video games, conceived as tools of cognitive socialization for the world of computers and high technology. The particular educational problem addressed was the unequal cognitive socialization of males and females in this domain. An experiment tested a strategy of using informal educational experience (video game play) to equalize spatial skills in boys and girls.

The two sets of studies together provide a broad picture of how contrasting cultural tools are each part of a highly integrated system that includes the levels of individual cognitive development, processes of informal education, and adaptation for survival (in the broadest sense) under particular economic, societal, and technological conditions.

The studies of video games in the United States dealt with an educational problem reelvant to post-industrial societies, while the studies of weaving in Zinacantan dealt with a set of edcuational issues relevant to preindustrial societies moving into the modern world. Because our post-industrial society in the United States also contains immigrants coming from preindustrial social backgrounds, both kinds of study have educational relevance to the problems of diversity in our own educational system.

Changes in Plans

The only change in the Zinacanteco Mayan research was a change in the time line. As indicated in earlier annual reports, problems in the availability of the research team caused a delay of one year in starting the field research. Instead of summer 1990, the field research was carried out in summer 1991. The delay in carrying out the field research also delayed the data analysis beyond the time of the original grant.

One major change was made in the video game research. The proposed study 2 was not done; only study 1 was carried out. One reason for this change was that the results of study 1 were so conclusive. A second reason for the change was to be able to devote more resources to the studies in Mexico described earlier.

The timeline change and the deletion of videogame study 2 were done in close consultation with staff at the Spencer Foundation.

Findings

Social change, informal education, and cognitive processes: A two-decade follow-up among the Zinacanteco Maya of Chiapas, Mexico

A theory had been developed (Greenfield, 1984; Greenfield & Lave, 1982) that there is a contrast between the goals of two methods of informal education: scaffolding (or guided participation, as it is sometimes called) with observational models (1970), on the one hand, vs. relatively independent trial-and-error learning on the other. Whereas the first is adapted to the transmission of tradition (and was what we found in 1970), the second, with its emphasis on the learner's own discovery processes, is adapted to the development of skill in innovation (expected in 1991). If innovation had entered the culture as a value orientation in response to entrepreneurship, it was thought that weaving education would make a corresponding shift away from scaffolding (or developmentally sensitive guidance) to a more discovery-oriented and independent trial-and-error process.

A second prediction was that weaving artifacts would no longer be limited to a small stock of patterns; instead weavers would constantly innovate new patterns. This was conceived of as a major developmental process. Both these hypotheses were formulated on the basis of theory alone. The principal investigator had not been back to Zinacantan in 21 years.

Both of these predictions were confirmed: First, our video study of the daughters and other descendents of our 1970 weaving subjects indicated that the learning of weaving had, in the intervening two decades, become more independent, with less guidance and modeling. Second, there was constant pattern innovation in both weaving and embroidery. No longer was

there a finite stock of patterns, as there had been two decades earlier. In addition, woven and embroidered motifs were combined and recombined in a potentially infinite variety of ways, adding to the innovative quality of the pattern construction process.

An unanticipated corellary to the predicted design innovation was the development, on the cultural level, of a whole set of metarepresentational tools, that is tools, for creating representations. These included printed design books and the drawing of patterns. No metarepresentational tools had been available two decades earlier.

Our historical study of weaving instruction indicates that the process of socialization prepares the next generation to participate in society, even under conditions of societal change. Even in Zinacantan, a society that, in 1970, was based on respect for tradition, we found that changing socialization patterns are indeed a very real component of the psychological adaptation to social change. Ours is the first direct longitudinal empirical historical evidence on this issue in the psychology of teaching and learning.

We have found that parents do not merely recreate the socializing process that they underwent as children. There is a tremendous capacity to develop new methods of cultural apprenticeship as societal conditions, in this case, economic conditions, change. These new methods entail changes in human relations, as well as changes in cultural artifacts. More broadly, our study of three generations of Zinacanteco weavers - grandmothers, mothers, and daughters - exemplifies learning and teaching as key components of the human capacity to adapt to a changing environment.

The second study in Nabenchauk used experimental means to explore historical change in pattern representation, conceived as a cognitive skill relevant to weaving. Major results so far are (1) an historical increase in use

of an abstract (rather than detailed) representational strategy and (2) the introduction of the abstract analytic strategy for representing woven patterns, a strategy that had been used by U.S. college students but never by Zinacantecos two decades earlier. Finding 2 was as predicted in the original proposal; no prediction concerning Finding 1 had been made.

The major significance of this experimental study of pattern representation is that it is, to our knowledge, the first direct, experimental demonstration of historical change in cognitive strategies as a function of changing ecocultural conditions.

Cultural tools in the computer age: Cognitive consequences of video games as informal education.

The study of the cognitive effects of video game play, carried out in collaboration with K. Subrahmanyam, used the arcade-style (but nonviolent) game of Marble Madness as informal education to improve performance on a battery of dynamic spatial tasks. As predicted, video game practice improved spatial performance.

Another prediction was that practice would be especially beneficial to girls who, on the average, start out with weaker spatial skills. The pattern of results was slightly different from this prediction, but equally interesting: video game practice improved the spatial performance of those children who started out with relatively weak spatial skills, boys as well as girls. However, because girls more often than boys started out with relatively less developed dynamic spatial skills, girls' spatial performance tended to benefit more from extended video game practice than did that of boys, who often started out with relatively good spatial performance. From an educational standpoint, nonviolent video games may quite useful in narrowing the gender gap in spatial skills.

Dissemination

Preliminary findings of the Zinacanteco research have been presented at the American Psychological Association (Washington, DC, 1992), the Society for Cross-Cultural Research (1993), the Society for Research in Child Development (New Orleans, 1993, paper appended), the American Psychological Society (Chicago, 1993), the International Society for the Study of Behavioral Development (Recife, Brazil, 1993), a workshop on culture and cognition (Marigogi, Brazil, 1993), University of California, San Diego (1992), UCLA (1991, 1992, 1993), University of Maryland (1992), University of Michigan (1992), and City University of New York (1994). The SRCD paper (Greenfield, 1993) is now being distributed via ERIC.

In terms of publication, it was felt important to publish the historical Zinacanteco research as a whole, rather than by way of piecemeal articles. Currently plans are underway to submit this material as a Monograph of the Society for Research in Child Development (SRCD Monographs). This monograph series reaches the 5000 plus members of the Society for Research in Child Development.

The final results of the video game study have been published in a special issue of the Journal of Applied Developmental Psychology (Subrahmanyam & Greenfield, 1994, appended). This special issue (Greenfield & Cocking, 1994), which includes three additional empirical articles from the P.I.'s lab, was prepared with support from the Spencer Foundation. The special issue will be expanded as a book entitled Interacting with Video, to be published in 1995 by Ablex in their Applied Developmental Psychology series.

As suggested in Spencer Foundation's guidelines, this final report willbe submitted to ERIC

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